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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/804,217	03/12/2001	Katsuya Sangu	424P045	8913

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EXAMINER

STREGE, JOHN B

ART UNIT	PAPER NUMBER
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2625

DATE MAILED: 06/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/804,217

Applicant(s)

SANGU ET AL.

Examiner

John B Strege

Art Unit

2625

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-17,19 and 20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1,3-10,12-17,19 and 20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☒ Certified copies of the priority documents have been received in Application No. 1.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Response to Arguments/Amendments

In response to applicants' amendment received 4/08/04, all requested changes to the specification and claims have been entered. Claims 2 and 18 have been cancelled.

Based on the amendment of claim 7 to depend from claim 4 the USC 112 rejection of claim 7 is hereby withdrawn.

Applicant's arguments regarding the USC 102 and USC 103 rejections have been fully considered but they are not persuasive.

Applicants' argue that Zachman does not disclose a projection screen that can convert the X-rays into visible rays or ultra violet rays or infrared rays that can be sensed by usual CCD cameras. However, this is disclosed on col. 5 lines 7-10 of Zachman's disclosure where it is recited that an x-ray image of a particular fixture hole and the fiducial pad may be viewed at the image display. Here the image display can be read as the projection screen as it projects a visible image of the x-ray image onto a screen. Applicants' further argue that there is no visible mask mark and Zachman does not have to treat both visible and invisible marks. However, the claim language does not clearly define visible or invisible marks. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Based on the amended portion of claims 1 and 17, the USC 102 rejection has been withdrawn for these claims, however these claims are rejected now by USC 103 as will be discussed below.

Applicants' further argue the USC 103 rejections by stating that Smith does not include a projection screen to convert invisible rays into visible rays (with CCD cameras). However, Smith discloses that fluorescent X-ray detector 17 (figure 1) is used to detect the substrate alignment mark (col. 3 lines 23-25) and further that one can achieve alignment of mask and substrate alignment marks by observing the magnitude of the signal and moving the substrate using the substrate motion system 21. This can be read as the projection screen.

Applicants' arguments regarding claims 3 and 20 are moot based on the new grounds of rejection necessitated by amendment.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 1, 3-8, 17, and 19-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "said adjusting mark" in line 15. There is insufficient antecedent basis for this limitation in the claim. For examination purposes the examiner will consider that the adjusting mark is on the object as stated in the original claim 2 (filed 3/12/01). Claims 3-8 depend on claim 1 and are thus rejected for the same reason.

Claim 17 recites the limitation "the steps" in line 4. There is insufficient antecedent basis for this limitation in the claim. Furthermore lines 4-5 disclose forming a

conductive pattern by an aligner, but according to the specification a mask forms the conductive pattern. For examining purposes the examiner will assume the mask forms the conductive pattern. Claim 20 is dependent on claim 17 and is thus rejected for the same reason.

Claim 19 discloses information that is not supported by the specification. Specifically, because of the amendment claim 17 reflects the system shown in figure 1 since it incorporates the photo mask. However, claim 19 deals with the via hole production as seen in figures 5 and 6 which do not deal with photomasks. Therefore this claim has limitations from two different embodiments that are not disclosed as being useable together.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 16 rejected under 35 U.S.C. 102(b) as being anticipated by Zachman et al. USPN 5,111,406 (hereinafter "Zachman").

Claim 16 discloses, "Apparatus for boring a hole through laminated printed circuit boards that compiles a plurality of circuit boards used in a producing process of said laminated printed circuit boards, comprising a mark that can be imaged by Xrays formed

on at least one of said boards, means for irradiating Xrays on an area containing said mark, a projection screen that can convert Xrays to one of visible rays, ultra violet rays or infrared rays for projecting said mark irradiated by Xrays thereon, means for moving at least one of said boards and a boring point of the apparatus for boring based on said mark projected on said projection screen so as to set up said boring point.”

Zachman discloses a method for determining a drill target location on multilayered boards (col. 1 lines 5-10). Zachman also refers to laminated circuit boards (col. 1 lines 25-30). Zachman discloses adjusting the position between a drill (an object) and a multi-layered board (at least col. 5 lines 21-23). Each layer has an electrically non-conductive substrate material having conductive patterns formed thereon (at least col. 3 lines 42-60) (as shown in figure 2). The disclosure contains holes in the solder pads (marks) on the layers that are imaged by x-rays irradiated on the area containing the holes (as seen in figure 3) (col. 3 lines 30-41). An x-ray image is created that converts the X-rays into visible light and may be viewed at the image display (20 of figure 1) (col. 5 lines 7-9). The multilayered board is mounted on a table movable in the x and y directions (col. 4 lines 53-54). The information received from the images is used to find an offset position used for drilling in a drilling machine (col. 5 lines 21-23).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1,3, 9-10, 12, 14,17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith USPN 3,984,680 in view of Zachman et al. USPN 5,111,406.

As seen in figure 1 Smith recites an alignment method to align one or several masks (corresponding to the object) relative to a substrate by emitting soft x-rays 11 such that the x-rays pass through multiple alignment marks 13 on a mask 22 and also an alignment mark 15 on a substrate 14 and are imaged onto a fluorescence detector 17 (first paragraph col. 3)(thus adjusting the position between the substrate and an object). As can be seen the mask faces one side of the substrate. The mask has a pattern as can be seen in figure 3. The fluorescence detector converts the x-rays into a visible indication that is used to implement the substrate motion system 21 (col. 3 paragraph starting on line 45)(corresponding to the projection screen). Therefore the substrate motion system is based upon the board mark projected onto the detector, and it is disclosed that there could be a method to move the mask as well (col. 2 lines 32-35)(corresponding to a means for moving said object). Smith states that his method deals with a mask "to be exposed" by lithography (col. 1 line 11). Therefore since it deals with lithography there must be a light source present in order to expose the mask.

Smith does not explicitly state that his invention can be used in order to produce a multi-layered circuit board. However, Smith states explicitly that "soft x-ray lithography is also an effective and convenient means of fabricating microelectronic devices" (col.1 lines19-22) which means that it could be used to produce a multi-layered wafer.

The production of multi-layered circuit board that include a plurality of insulated layers and a plurality of conductive layers having a conductive pattern is well known in the art. One such example comes from the disclosure of Zachman. Zachman discloses that multi-layered circuit boards can have problems with misregistration (col. 1 lines 25-37) as is well known in the art.

Smith and Zachman are analogous inventions because they are from the same field of endeavor of using x-rays to align two objects.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Smith and Zachman in order to obtain an apparatus for producing a multi-layered circuit board. The motivation for doing so would be to use the invention of Smith that would apply equally effectively to the production of multi-layered circuit boards as disclosed by Zachman. Therefore it would have been obvious to one of ordinary skill in the art to combine Smith and Zachman in order to obtain the invention as specified in claims 1 and 9.

Regarding claim 3, Smith discloses that fluorescent X-ray detector 17 (figure 1) is used to detect the substrate alignment mark (col. 3 lines 23-25) and further that one can achieve alignment of mask and substrate alignment marks by observing the magnitude of the signal and moving the substrate using the substrate motion system 21.

Claim 12 discloses, "Apparatus of claim 9, wherein; said projection screen is mounted on said photo mask." As can be seen in figure 1 the fluorescent detector screen is mounted on the photo mask.

Claim 14 discloses, "apparatus of claim 9 wherein; said projection screen is a fluorescent screen." Smith discloses a fluorescent detector 17 (figure 1) (col. 3 line 32).

Claim 10 discloses, "apparatus of claim 9, further comprising; an image recognition means for recognizing said mask mark of the photo mask and said board mark projected on the projection screen, wherein said means for moving moves at least one of said board and said photo mask so as to make said mask mark and said board mark positioned in a certain relation." As discussed above Smith combined with Zachman disclose all of the limitations of claim 9. Smith nor Zachman explicitly discloses an image recognition means. Smith discloses that the alignment of the mask and mark can be achieved by either a manual process wherein an observer sets the substrate motion system into action after observing the positions on the detection screen or by using an automatic process using the marks on a detection screen (col. 3 lines 45-60). These could be considered to be image recognition means that move the substrate in order to put it into position with the mask.

Claim 17 has similar limitations to claims 1 and 9, except for the additional limitation of "including the steps of forming a conductive pattern by an aligner and forming a mark for position adjustment on a photo mask of the aligner." Smith discloses a mask 20 with multiple alignment marks for forming a conductive pattern. These marks are used as stated above to adjust the position of the mask to the substrate.

Regarding claim 20, this limitation is addressed above in the rejection of claim 3.

6. Claims 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith USPN 3,984,680 in view of Zachman et al. USPN 5,111,406 in view of the known background information disclosed by the applicant.

Claim 4 discloses, "apparatus of claim 1 wherein: said mark that can be imaged by Xrays is formed on a core board of the multi-layered printed circuit board." As discussed above the combination of Smith and Zachman disclose all of the limitations of claim 1. Zachman discloses in figure 2 that all the layers contain the solder marks used to form the images in the x-ray. Zachman does not explicitly disclose that there is a core board in the multiple layered board and that this core board contains the solder marks, however the applicant states that the "multi-layered printed circuit board has a core board...(with) conductive patterns" (first paragraph of the background). If a multilayered board contains a core board with conductive material it would be obvious to treat the board the same as the other layers (thus giving it a solder mark) in order that the conductivity of board remains connected throughout.

The combination of Smith and Zachman and the applicants' known background information are analogous art because they are from the same field of endeavor of using x-rays to process a multilayered board. At the time of the invention it would have been obvious to have solder holes on the core board of the multilayered board. The motivation for doing so has already been stated above. Therefore it would have been obvious to combine Smith and Zachman with the known background art disclosed by the applicant in order to obtain the invention as specified in claim 4.

Claim 7 discloses, "apparatus of claim 4 wherein; said object is provided with visible first and second marks, the core board is provided with a visible second board mark, the relative position of said core board and said object are adjusted so as to place said second mark and said second board mark in the predetermined positioning relation under a visible condition, said Xray irradiation device is moved so as to place the projection shape of the board mark on the projection screen and the first mark in the predetermined positioning relation before said adjusting the relative position between the board and the object."

Zachman discloses multiple marks on the multi-layered board. Smith discloses adjusting the substrate and the mask in order to align the marks on the masks with the mark on the substrate. Smith, nor Zachman explicitly disclose that there is a core board in the multiple layered board and that this core board contains the solder marks, however the applicant states that the "multi-layered printed circuit board has a core board...(with) conductive patterns" (first paragraph of the background). If a multilayered board contains a core board with conductive material it would be obvious to treat the board the same as the other layers in the disclosure of Zachman (thus giving it a solder mark) in order that the conductivity of board remains connected throughout.

Smith, Zachman, and the background information of the applicant are all analogous art because they are all from the same field of endeavor of using x-rays. At the time of the invention it would have been obvious to combine Smith, Zachman and the background information of the applicant. The motivation for doing so would be to obtain a method of aligning a multi-layered board to a mask as is needed in order to

solve misregistration problems. Thus it would have been obvious to one of ordinary skill in the art to combine Smith, Zachman, and the known background art of the applicant in order to obtain the invention as specified in claim 7.

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith USPN 3,984,680 in view of Zachman et al. USPN 5,111,406 and further in view of Tabarelli et al. USPN 4,346,164 (hereinafter "Tabarelli").

Claim 13 discloses, "Apparatus of claim 9 further comprising; a projecting lens for projecting said pattern of said photo mask, wherein said projection light source projects said pattern of said photo mask via said projecting lens onto said board." As discussed above, Smith combined with Zachman disclose all of the limitations of claim 9. Smith nor Zachman explicitly disclose a projecting lens, however Smith does disclose a lithography process and a light source, and it seems obvious that there would be a lens involved in order to direct the light source. With any lithography process a light projects a pattern of a mask onto an object. A lens to direct a light source is not a novel idea.

Tabarelli discloses projection lens 3 (figure 4) that is used to direct a lithography pattern onto a circuit and states that using the projection lens give the advantage of higher resolution of the lithography pattern (col. 3 lines 16-37). At the time of the invention it would have been obvious to combine Smith, Zachman, and Tabarelli in order to obtain a method for aligning a mask and a multi-layered circuit that uses a projection lens to direct the lithography pattern through the mask. The motivation for

doing so would be (as stated by Tabarelli) to obtain higher resolution of the lithography pattern. Thus it would have been obvious to one of ordinary skill in the art to combine Smith, Zachman, and Tabarelli in order to obtain the invention as specified in claim 13.

8. Claim 5 rejected under 35 U.S.C. 103(a) as being unpatentable over Smith USPN 3,984,680 in view of Zachman USPN 5,111,406 and further in view of Toth et al. (hereinafter "Toth").

Claim 5 discloses, "apparatus of claim 1 wherein: said means for irradiating X-rays comprises an X-ray irradiation device, and wherein the position of said X-ray irradiation device is corrected before said positioning." As stated above Smith and Zachman disclose all of the limitations of claim 1 and Smith discloses an x-ray device. Although the invention disclosed by Smith might include correction of the x-ray device position, it does not explicitly disclose that the position of the x-ray irradiation device is corrected.

Toth discloses an x-ray irradiation device and discloses a step where adjustment or correction of the position of the x-ray beam is performed (first full paragraph of col. 7).

Smith, Zachman, and Toth are all analogous art because they are all from the same field of endeavor of using x-rays. At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Smith and Zachman as specified above and further to combine Toth in order to obtain an x-ray irradiation device that is corrected before positioning. The motivation for this would be to obtain accurate images of the multilayered board and increase the processing time by making adjustments in

the x-ray device in an efficient manner. Therefore at the time of the invention it would have been obvious to one of ordinary skill in the art to combine Smith, Zachman, and Toth in order to obtain the invention as specified in claim 5.

9. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith USPN 3,984,680 in view of Zachman USPN 5,111,406 further in view of Toth et al. (hereinafter "Toth"), and further in view of Koymayama USPN 4,614,431.

Claim 8 recites, "apparatus of claim 5 wherein; the gap between the board and the object is increased when positioning the Xray irradiation device." Zachman, nor Toth, nor Koymayama disclose increasing the gap between the board and the object when positioning the x-ray device. Komeyama discloses an adjustable alignment apparatus system that uses x-rays to align a wafer and a mask. It suggests that when using a point source of radiation it may be necessary to adjust the wafer and the mask by increasing the gap so that the conductive pattern will be enlarged (col. 4 lines lines 50-65).

Smith, Zachman, Toth, and Koymayama are all analogous art because they are all from the same field of endeavor of using x-rays.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Smith, Zachman, Toth, and Koymayama in order to obtain an x-ray device that when positioned, increases the position between the board and the mask. The motivation for doing so would be to enlarge the conductive pattern on the circuit board. Therefore it would have been obvious to one of ordinary skill in the art to

combine Smith, Zachman, Toth, and Koymayama in order to obtain the invention specified in claim 8.

10. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zachman et al USPN 5,111,406 in view of Melcher et al. USPN 4,504,727 (hereinafter "Melcher").

Claim 15 discloses, "apparatus for boring a hole through multi-layers of a printed circuit board that includes a plurality of insulated layers and a plurality of conductive layers having a conductive pattern used in a producing process of a multi-layered printed circuit board, comprising a mark that can be imaged by Xrays formed on at least one of said layers of said multi-layered printed circuit board, means for irradiating Xrays on an area containing said mark, a projection screen that can convert Xrays to one of visible rays, ultra violet rays or infrared rays for projecting said mark irradiated by Xrays thereon, means for moving at least one of said multi-layered printed circuit board and a laser projection point of the apparatus for boring based on said mark projected on said projection screen so as to set up said laser projection point." Claim 15 is similar to claim 1 with the differences that it is a boring apparatus that uses a laser projection point, therefore except for these differences the rest of the limitations are disclosed by Zachman as stated in the rejection of claim 1 and will not be addressed again. Zachman discloses a method for determining a drill target location on a multilayered board (col. 1 lines 5-10). Zachman does not explicitly disclose a laser projection point used for boring.

Melcher discloses a method for drilling a hole in a multilayered circuit board wherein a laser is focused on the drill point (col. 5 lines 40-45). Melcher further discloses that "laser machining, such as drilling a hole on a workpiece, offers several advantages over more conventional machining techniques", these advantages include that a laser can be focused to an extremely fine point, the drilling can be performed with greater accuracy, etc. (col.1 lines 10-24).

Zachman and Melcher are analogous art because they are from the same field of endeavor of drilling holes in multilayered boards. At the time of the invention it would have been obvious to combine Zachman and Melcher in order to obtain a drill that utilizes laser technology. The motivation for using laser technology would be to gain some of the advantages as stated by Melcher. Thus, at the time of the invention it would have been obvious to one of ordinary skill in the art to combine Zachman and Melcher in order to obtain the invention as specified in claim 15.

Allowable Subject Matter

11. Claims 11 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. Claim 6 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B Strege whose telephone number is (703) 305-8679. The examiner can normally be reached on Monday-Friday between the hours of 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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